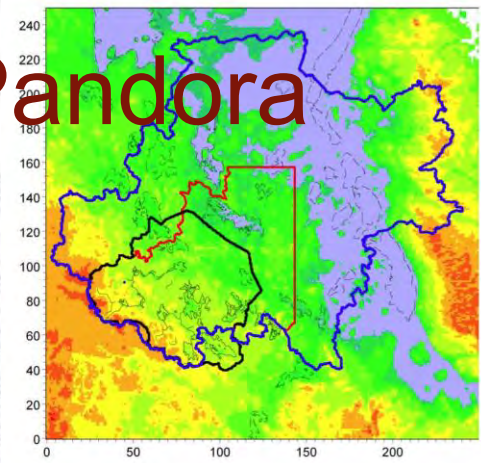
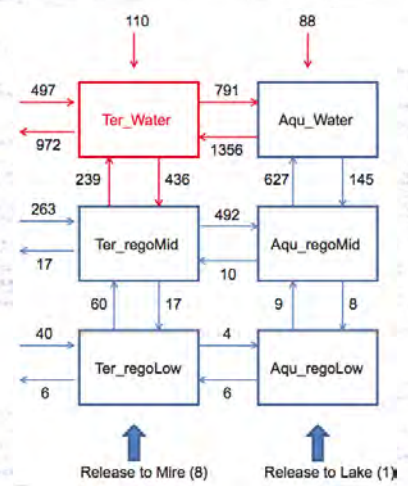


# Use of MIKE SHE to parameterize Pandora

- SR-site model was set up and calibrated based (R-10-02, p. 303)
  - Based on data from current state



- Results were delivered to dose calculations (TR-10-01, p. 342, Fig. 13.2; R-10-02, Fig. 8-5)
  - 5000 AD-model
  - $Aqu\_regoLow = (60 - 17) + (9 - 8) = 44 \text{ mm/y}$
  - $Ter\_regoLow = Aqu\_regoLow$
  - Six lakes were used to derive average information



- Pandora were used to derive LDF:s
  - $Aqu\_regoLow = Lake\_adv\_low\_mid$
  - Same value for all times





# Questions regarding the hydrological modelling and interpretation

1. Representativity of the averaging over six lakes vs. assumed leakage scenarios
2. Representativity of the parameterization based on AD 5000 vs. the significant change in wet area over time
3. The definition of top boundary condition as driver of the flow



# 1. Representativity of the averaging over six lakes vs. Assumed leakage scenarios

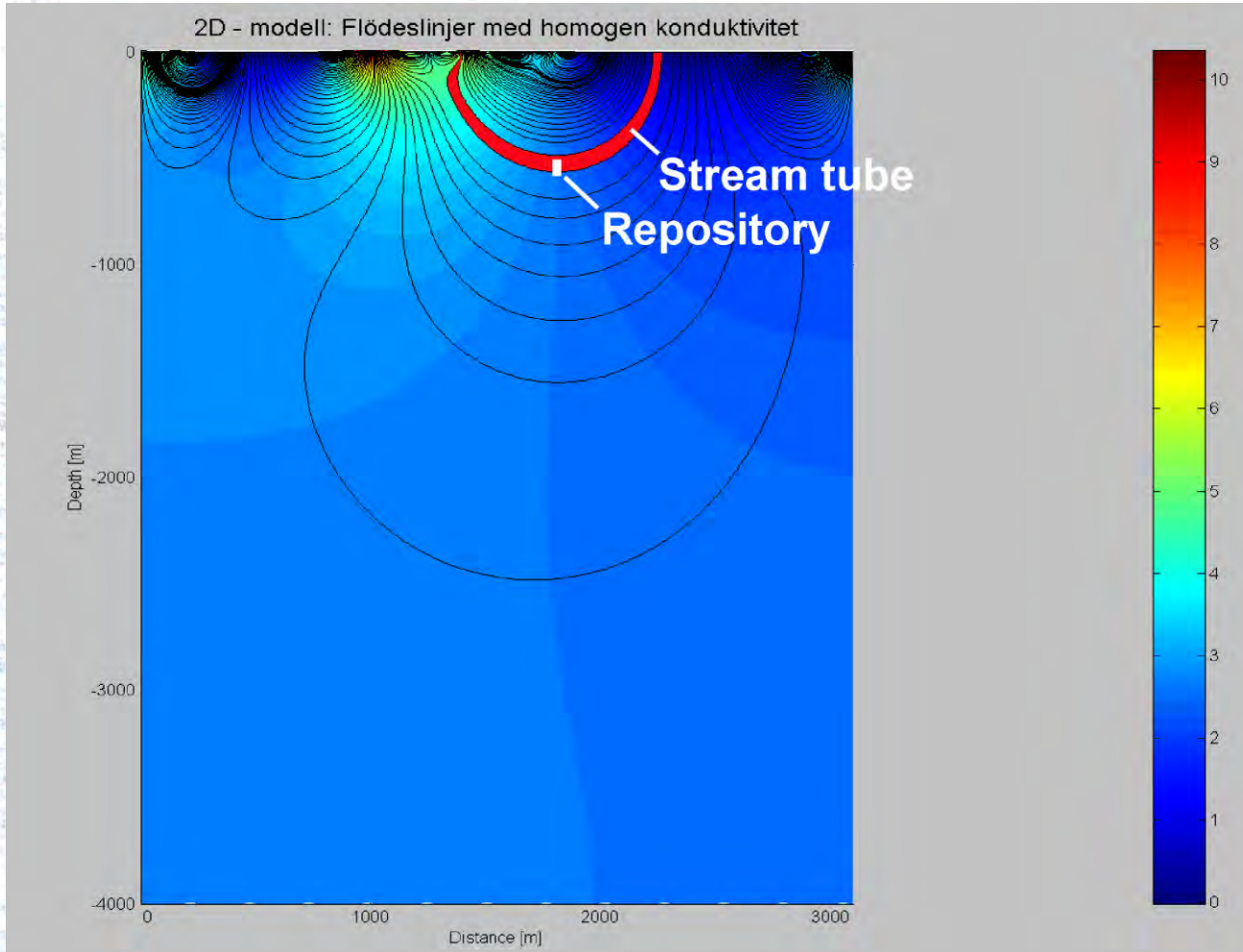
Lake\_adv\_low\_mid = 44 mm/y

- Average for six different lake areas
- difference in advection velocity between four different environments (Ter\_regoMid, Aqu\_regoMid, Ter\_regoMid and Aqu\_regoMid)
- Both re- and discharge areas are combined to get a net exchange flux.
- Rate coefficients for Regolith\_Low is 10 – 100 times larger, than
  - Compare results for Sea bottom, p. 308 R-10-08)
  - Marklund (2009) estimated flux at 500 m depth: < 0.5 mm/y

How can this averaging be representative to a scenario where radionuclides are leaking from the repository?



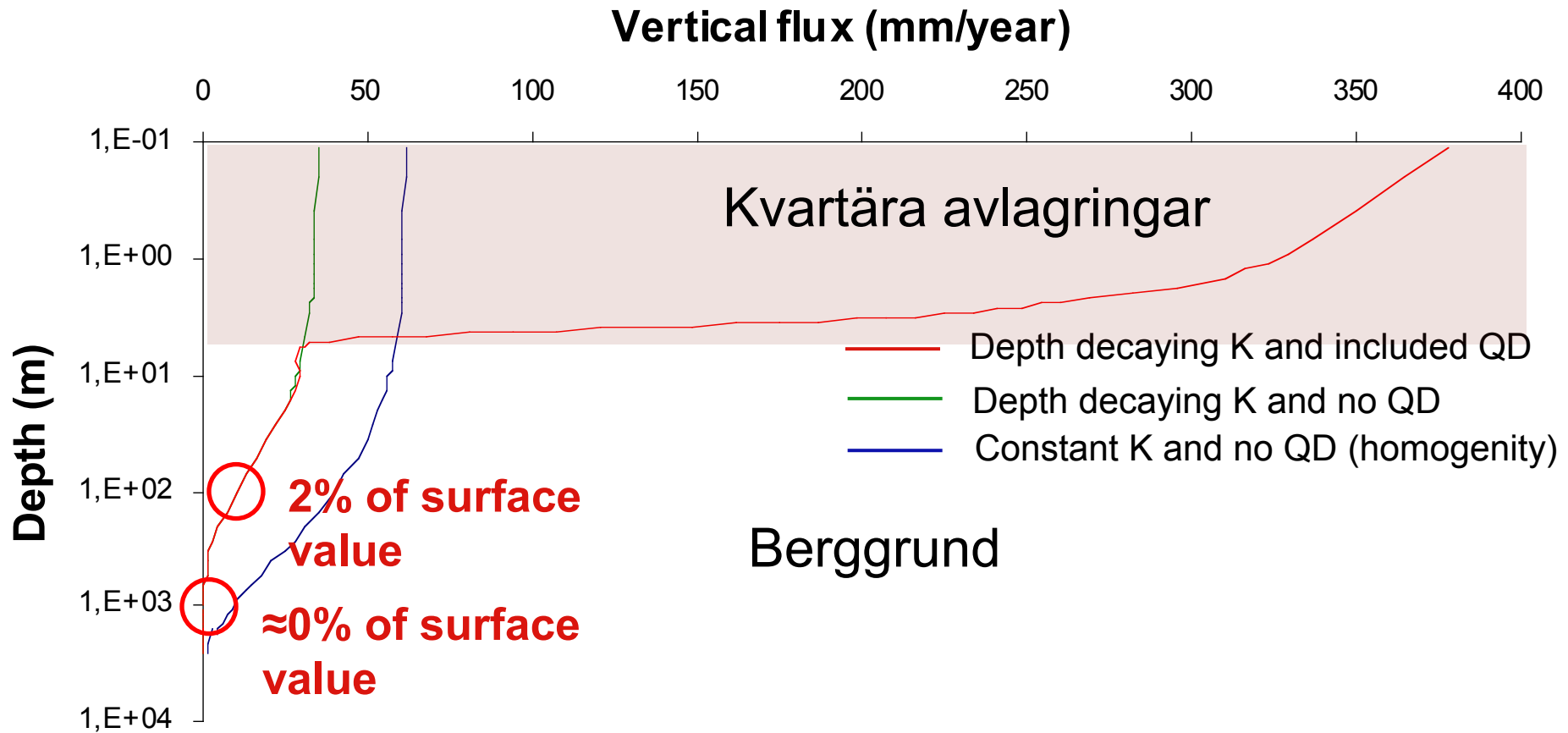
# Hierarchical system of flow cells



□ Escaping radionuclides follow water in stream tube that reaches repository depth

□ Fluxes (in stream tube) are small at 500 m depth

# Estimated mixing in Swedish landscapes

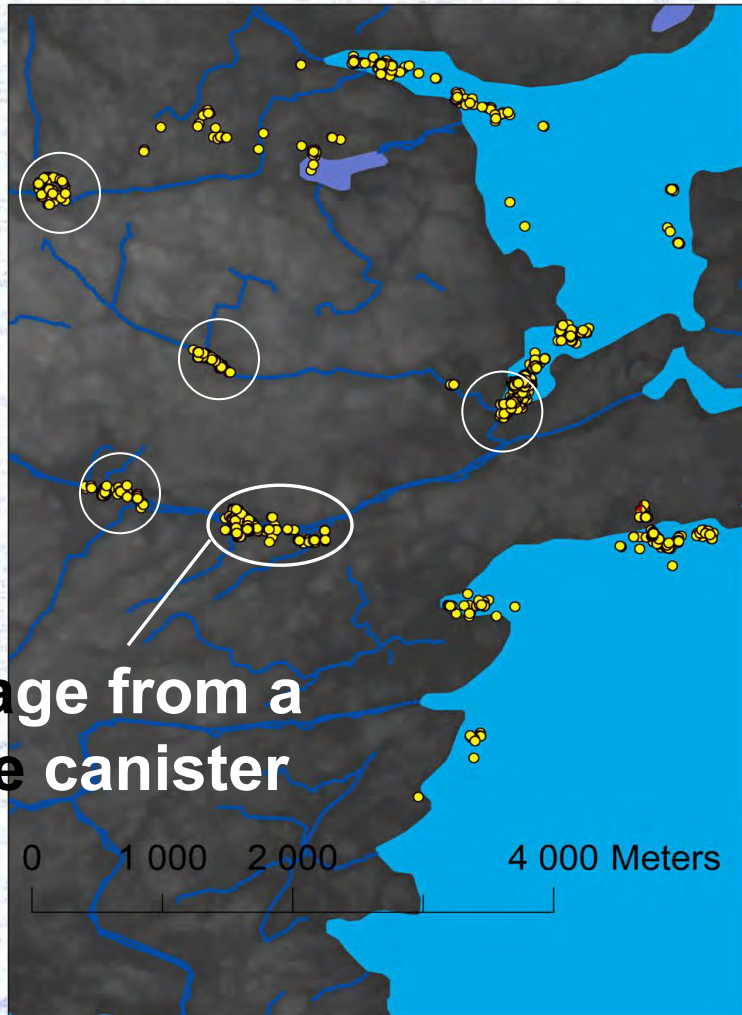


After Lars Marklund (2009)

- ❑ 20 domains (2,5x2,5 and 25x25 km<sup>2</sup>)
- ❑ Soil data from thousands of wells
- ❑ Topography from LMV (50 x 50 m)
- ❑ Precipitation from SMHI



# Utsrömningsområden i vattendrag och våtmarker

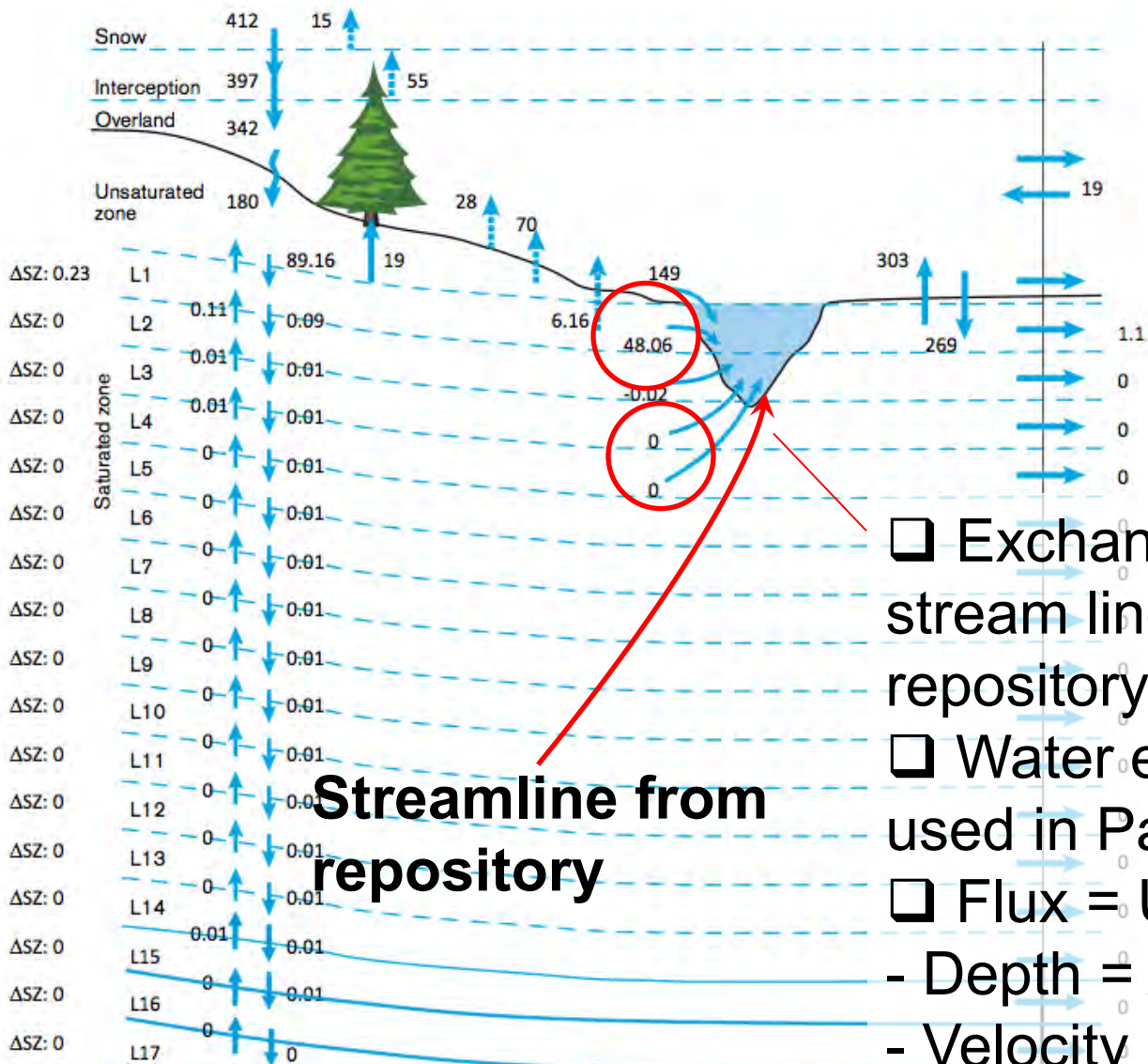


**Leakage from a  
Single canister**

- ❑ Hot-spots sammanfaller med
  - Dalgångar och vattendrag
  - tunna kvartära avlagringar
  - Sprickzoner
- ❑ Storleken på objekten avgör vilka topografiska skalor som styr fluxet vid ytan
  - Låga flux under sjöar och våtmarker
  - Vattendrag?



# Exchange rate for Forsmark Regolith



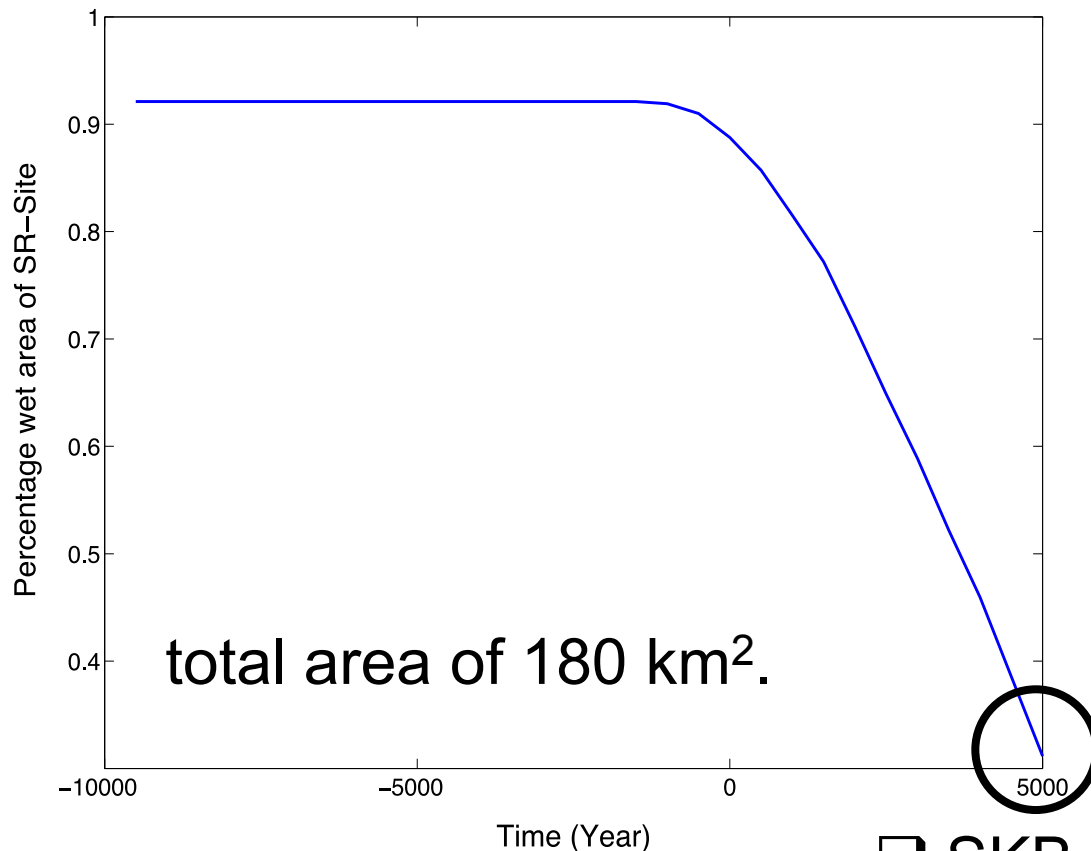
**Streamline from repository**

- ❑ Exchange velocity along stream line coming from repository is very *small*
- ❑ Water exchange 44 mm/y is used in Pandora calculations
- ❑ Flux = U (M/V) A, decoupled?
  - Depth = A/V
  - Velocity U

Figure 6-7, R-10-02

## 2. Representativity with regard to the significant change of the environment

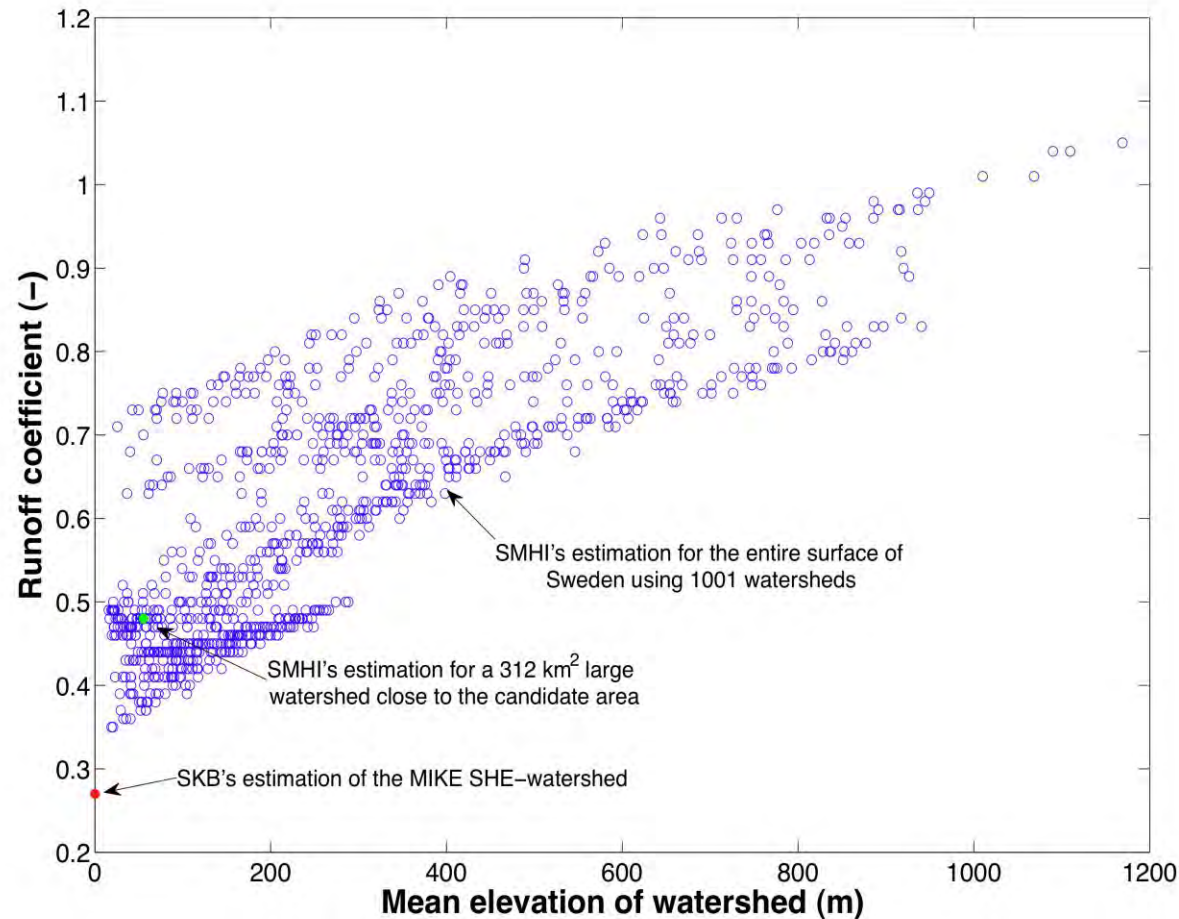
Percentage of wet area in SDM SR-site model



- ❑ SKB uses this “time” for estimation of water fluxes
- ❑ SKB assumes constant recharge



# The current state of runoff is extreme

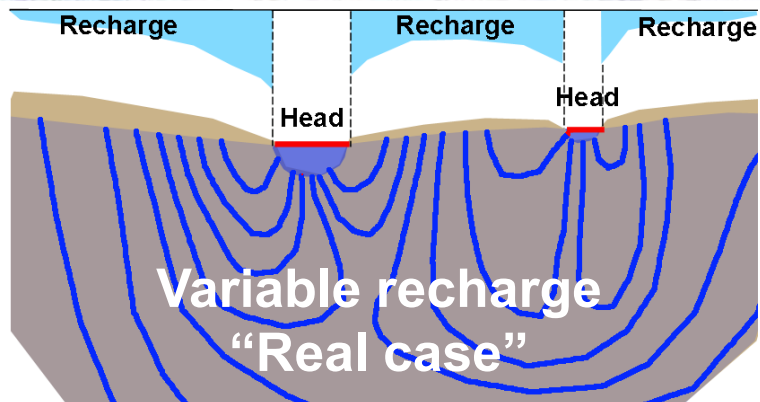


❑ What does the current hydrological status mean for generalization to AD 5000 and other scenarios?

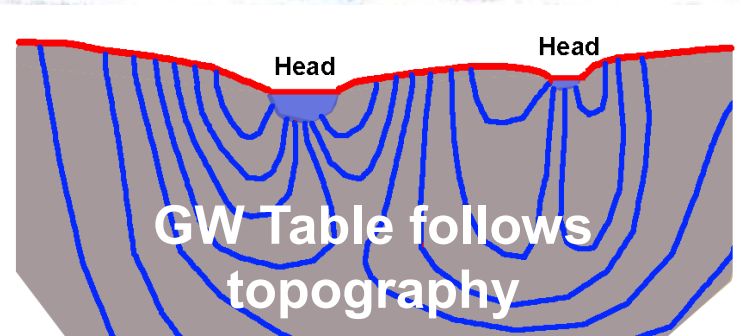
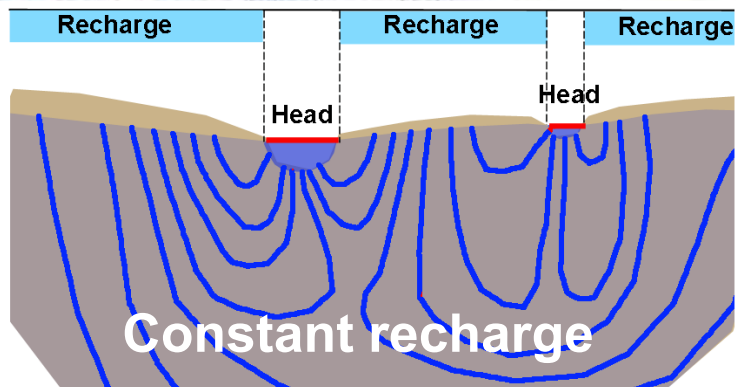
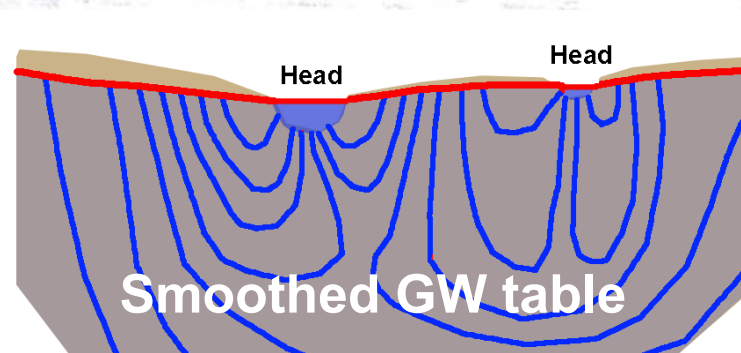


# 3. The definition of top boundary condition as driver of the flow

## Precipitation controlled B.C.



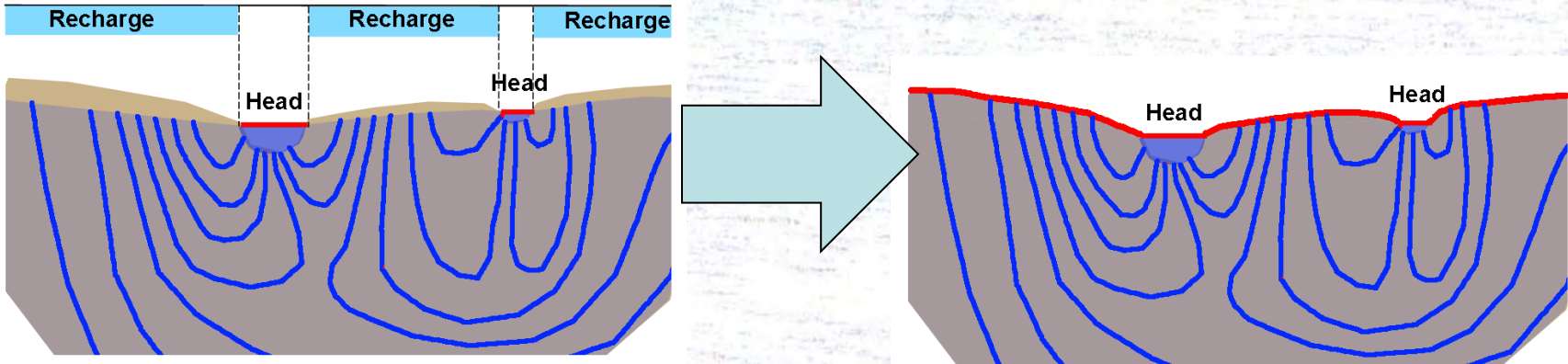
## Topography controlled B.C.





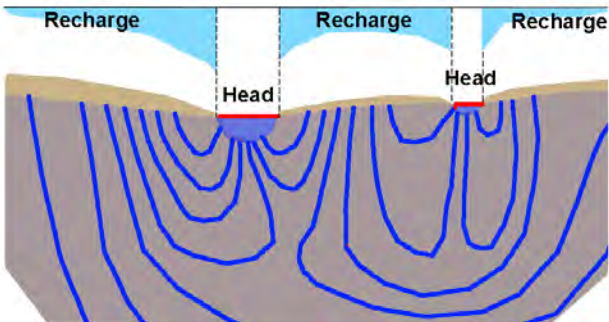
# SKB reports R-10-06 -> R-10-43

SKB tested changing top boundary condition



Specific flows at repository depth decreased ~10%

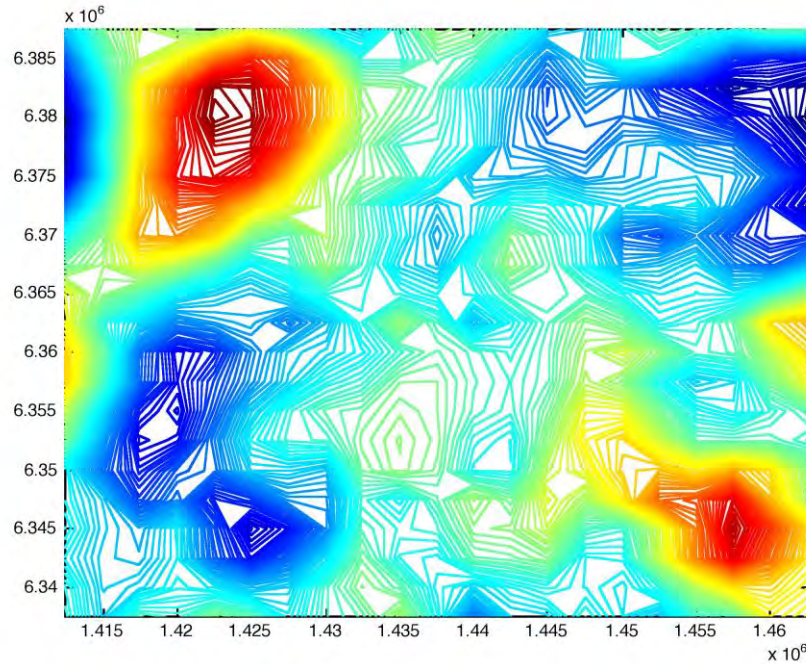
- Importance of real boundary condition?
- Importance to Lake\_adv\_low\_mid?



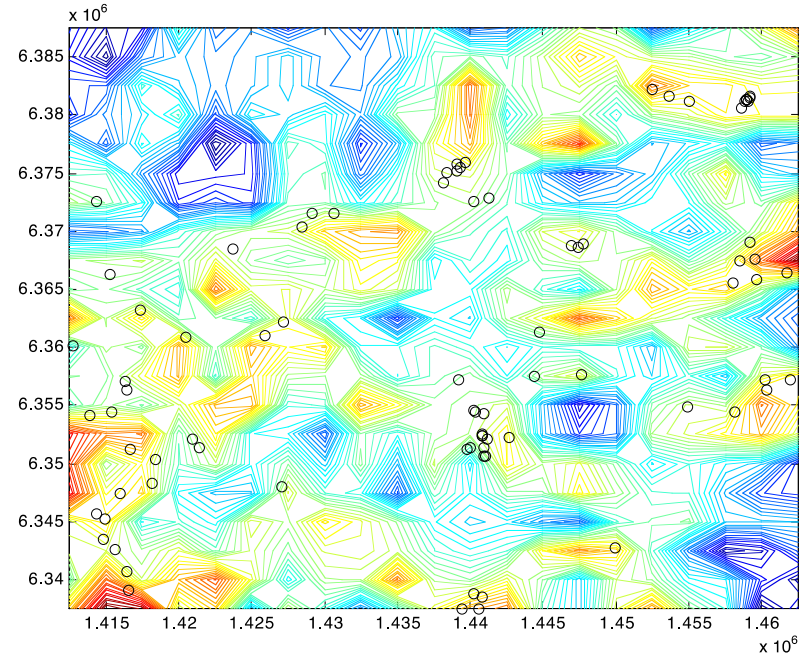


# Topography controlled surface fluxes

## Topography



## Surface flux



- Spatially variable
- Constant flux => slower circulation

How important is the selected boundary condition for parameterizing Pandora?



# Questions

❑ Representativity of the averaging over six lakes vs. assumed leakage scenarios

How can this averaging be representative to a scenario where radionuclides are leaking from the repository?

❑ Representativity of the parameterization based on AD 5000 vs. the significant change in wet area over time

What does the current hydrological status mean for generalization to AD 5000 and other scenarios?

❑ The definition of top boundary condition as driver of the flow

How important is the selected boundary condition for parameterizing Pandora?